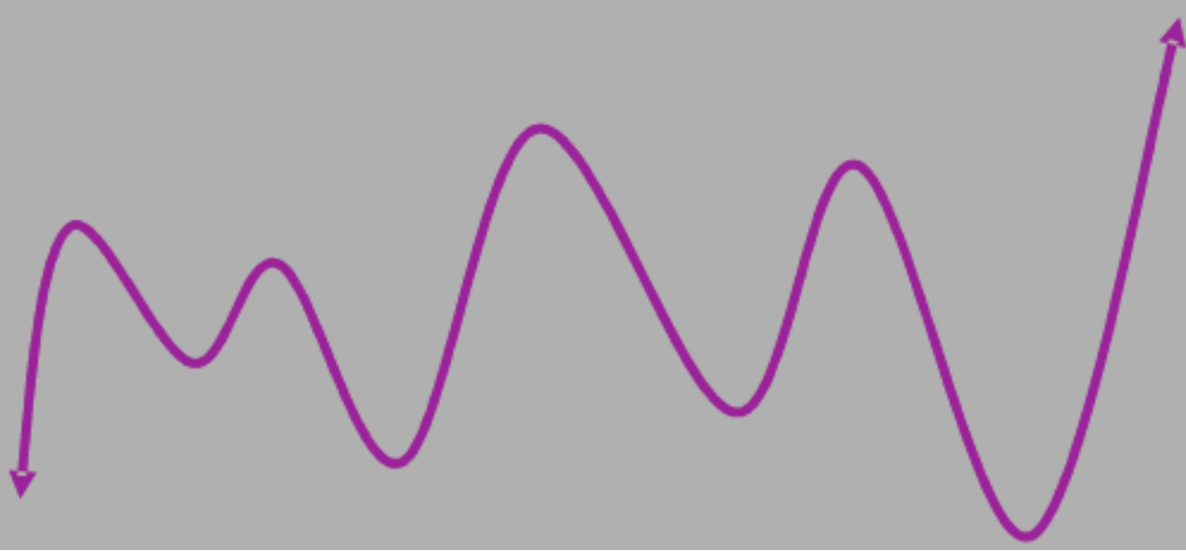
Polynomial Functions



Summary Statements:

- If a polynomial is to an odd power, then it looks like a cubic equation.
- If a polynomial is to an even power, then it looks like a parabola.
- The equation shows how many arcs are in the graph.
- The shape depends on the number of x's.

HOW?

Determine which of the following are polynomial functions. If the function is a polynomial, state its degree.

$$f(x) = 2x^{4} - x$$

A polynomial of degree 4.

We can write in an x^0 since this = 1.

$$g(x) = 2\,x^{0}$$

A polynomial of degree 0.

$$h(x) = 2\sqrt{x} + 1$$

Not a polynomial because of the square root since the power is NOT an integer

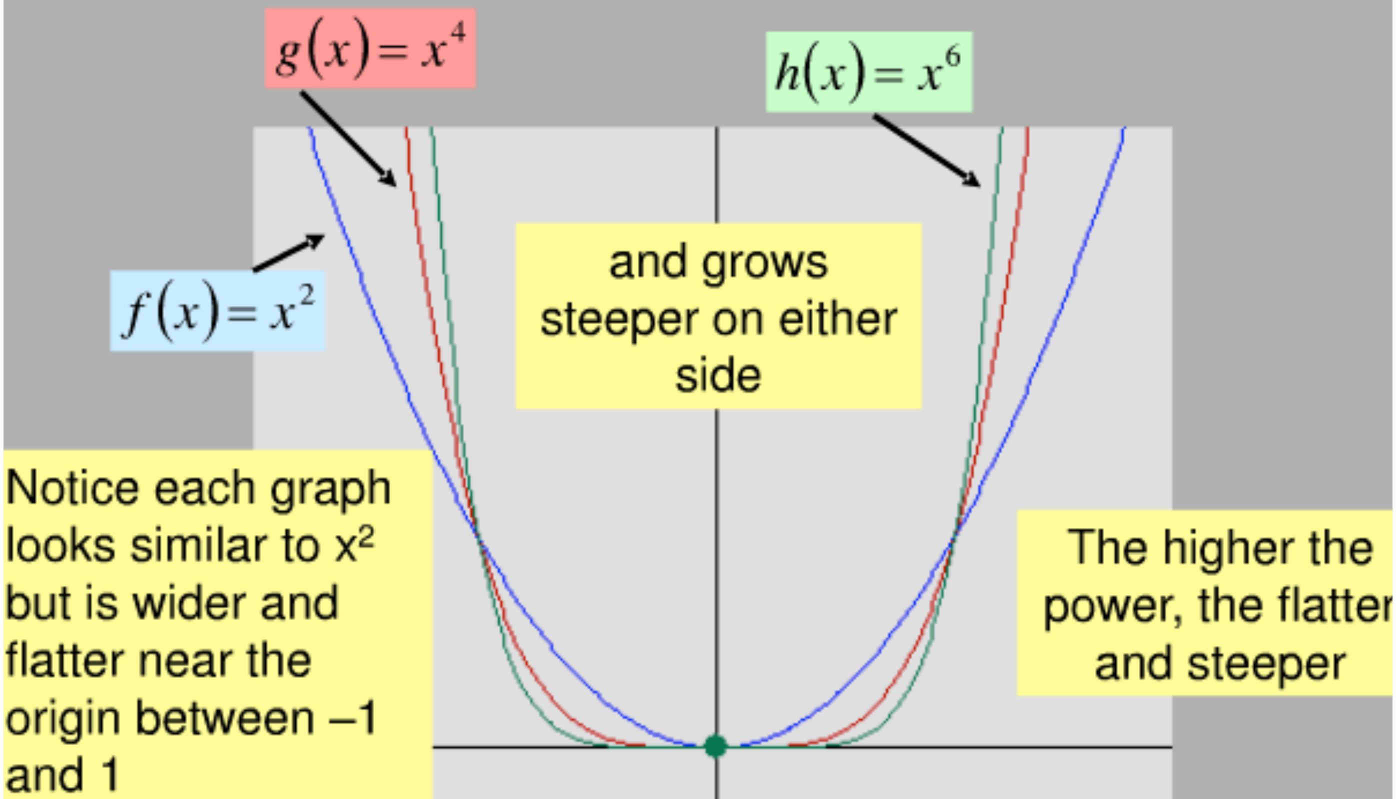
$$\sqrt{x} = x^{\frac{1}{2}}$$

$$F(x) = \frac{3}{x} + x^{2}$$

Not a polynomial because of the x in the denominator since the power is negative

$$\frac{1}{x} = x^{-1}$$

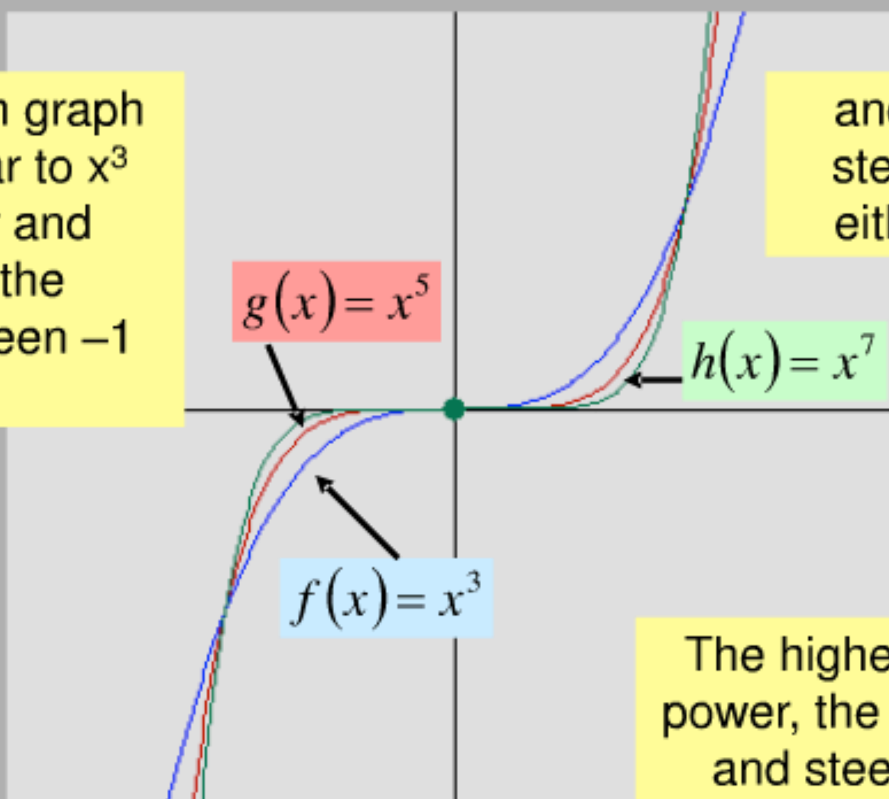
Let's look at the graph of $f(x) = x^n$ where *n* is an **even integer**.



Let's look at the graph of $f(x) = x^n$ where *n* is an **odd integer**.

Notice each graph looks similar to x^3 but is wider and flatter near the origin between –1 and 1

and grows steeper on either side



The higher the power, the flatter and steeper

and

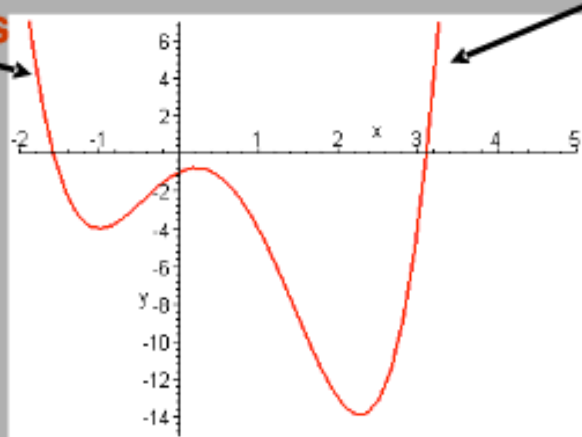
LEFT **RIGHT**

HAND BEHAVIOUR OF A GRAPH

The **degree** of the polynomial along with the **sign of the coefficient** of the term with the highest power will tell us about the left and right hand behaviour of a graph.

Even degree polynomials rise on both the left and right hand sides of the graph (like x^2) if the coefficient is positive. The additional terms may cause the graph to have some turns near the center but will always have the same left and right hand behaviour determined by the highest powered term.

left hand behaviour: rises

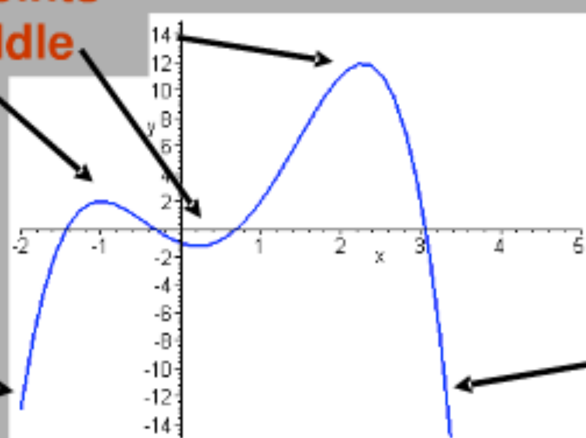


right hand behaviour: rises

Even degree polynomials fall on both the left and right hand sides of the graph (like $-x^2$) if the coefficient is negative.

turning points in the middle

left hand behaviour: falls

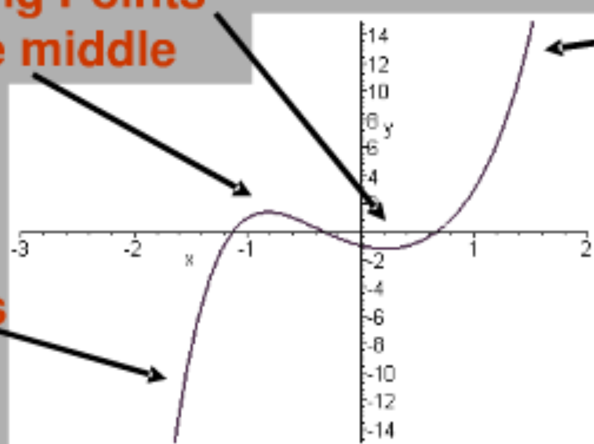


right hand behaviour: falls

Odd degree polynomials fall on the left and rise on the right hand sides of the graph (like x^3) if the coefficient is positive.

turning Points
in the middle

right hand
behaviour: rises

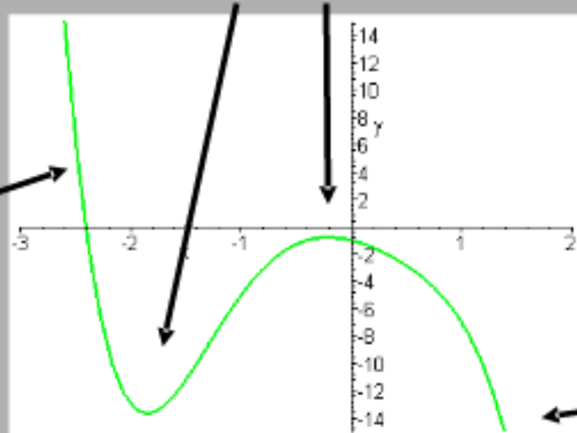


left hand
behaviour: falls

Odd degree polynomials rise on the left and fall on the right hand sides of the graph (like x^3) if the coefficient is negative.

turning points in the middle

left hand behaviour: rises



right hand behaviour: falls

$$0 = (x-2)(x+3)(x+1)(x-5)$$

x and *y* intercepts would be useful and we know how to find those. To find the *y* intercept we put 0 in for *x*.

$$f(0) = 0^4 - 3(0)^3 - 15(0)^2 + 19(0) + 30 = 30$$

To find the *x* intercept we put 0 in for *y*.

Finally we need a smooth curve through the intercepts that has the correct left and right hand behavior. To pass through these points, it will have 3 turns (one less than the degree so that's okay)